

इंटरनेट

मानक

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Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 11012 (1984): Technical supply conditions for reciprocating air compressors above 25 kW up to and including 60 kW [MED 22: Compressor, Blowers and Exhausters]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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Indian Standard

**TECHNICAL SUPPLY CONDITIONS FOR  
RECIPROCATING AIR COMPRESSORS  
ABOVE 25 AND UP TO AND INCLUDING 60 kW**

Compressors Sectional Committee, EDC 62; Panel for Technical Supply Conditions for Various Air Compressors, EDC 62/P-2 [ Ref : Doc : EDC 62 ( 3383 ) ]

**1. Scope** — This standard applies to reciprocating air compressors, above 25 and up to and including 60 kW, for stationary application.

**2. Terminology** — As given in IS : 5727-1981 'Glossary of terms relating to compressors and exhausters (first revision)'.

**3. Materials of Construction**

**3.1** A list of materials for various components and parts of the compressor is given in Appendix A for information.

**3.2** Pressure castings of cast iron shall be accepted if passing the following tests:

- a) Hydraulic test at 1.5 times the maximum operating pressure, and
- b) Pneumatic test at maximum operating pressure.

**3.3** All castings shall be sound, free of shrink or blow holes, cracks, scale blisters or other similar injurious casting defects. Surfaces of castings shall be cleaned by sand blasting, shot blasting, pickling, etc.

**4. Enquiry** — The purchaser shall complete the data as given in Appendix B to the extent possible and applicable and also specify any known abnormal conditions of working. In addition, purchaser may also specify additional requirements, if any.

**5. Proposal**

**5.1** The supplier shall include a data sheet in his proposal given in Appendix C and any other details required by the purchaser.

**5.2** The proposal shall include either a specific statement that all equipment are in strict compliance with the purchaser's specifications or a specific list of deviations therefrom shall be furnished.

**5.3** The supplier shall also submit a list of spare parts which are recommended for normal maintenance of the machine for a period of 2 years or 6 000 operating hours or one overhaul.

**5.4** The condition for erection and commissioning of compressor shall be as specified in the contract or order.

**6. General Requirements**

**6.1** Parts subjected to air pressure shall have sufficient strength.

**6.2** Design shall be such that no part of the compressor shall easily cause mechanical or electrical failure.

**6.3** Compressor shall be free from excessive vibrations and ready for normal operation.

**6.4** If electrical prime-mover is used, proper earthing shall be ensured.

**6.5** Every part shall have the interchangeability and shall be so constructed as not to cause any change in the performance by changing a part.

**7. Cylinder and Cylinder Head**

**7.1** Cylinder wall and cylinder head which are directly subjected to the pressure shall have no scantiness of the metal.

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**7.2** Maximum allowable working pressure shall exceed rated discharge pressure by at least 15 percent or 1 bar whichever is greater but shall not be lower than safety valve set pressure.

**7.3** Cylinders shall be spaced and arranged to permit access to all openings, valves, packings and controls without removing the cylinder, cylinder head or major piping.

**7.4** Cylinder shall have adequate cooling provision.

**7.5** The design pressure of water jacket, in case of water-cooled compressors shall not be less than 0.5 MPa unless a lower pressure has been specified in the contract or order.

**7.6** Cylinder head shall bear the hydrostatic test of the same pressure with that of the cylinder. When gaskets are inserted between the cylinder and the cylinder head, a gasket of uniform thickness, heat resistant, oil proof and pressure resistant shall be used.

### **8. Piston, Piston Rings and Piston Rod**

**8.1** In case piston rod is used, the attachment shall be positively locked.

**8.2** Piston rods shall be furnished with fine threads. The material shall be alloy steel conforming to Grade 40Cr4Mo3 *Min* of IS : 1570 ( Part 4 ) 'Schedules for wrought steel : Part 4 Alloy steel' ( *under preparation* ).

**8.3** The manufacturer shall make available readily oversize pistons and rings to conform to standard oversize cylinder bores.

**8.4** The actual rod loading, calculated on the basis of maximum allowable working pressure and considering part load operation, if applicable, shall not exceed the manufacturer's maximum allowable rod-load for the compressor. The same shall be made available to purchaser on demand.

### **9. Crankshaft, Connecting Rod and Bearings**

**9.1** Crankshaft and connecting rods shall be made of ductile materials.

**9.2** Crankshaft shall be in one piece ( but may have provision for removable counter weights ) and shall be suitably heat treated, ground or lapped.

**9.3** The crankshafts shall be dynamically balanced in case running at 800 rev/min or above.

**9.4** Any holes required for lubrication in crankshafts or connecting rod shall be drilled and not cored.

**9.5** Crank bearings and main bearings shall be of replaceable precision type.

### **10. Valves and Filters**

#### **10.1 Valves**

**10.1.1 Safety valves** — Each stage shall be protected by a safety valve. This safety valve shall be dimensioned for full compressor capacity with set pressure not more than maximum allowable working pressure for that stage.

The safety valves shall be mounted in such a manner that the setting is not disturbed by the vibration.

No additional safety valve after the final stage is required if a safety valve of proper size is provided on the air receiver and there is no stop valve from discharge of the final stage and the air receiver.

#### **10.2 Filters**

**10.2.1** The purchaser shall specify if there is any particular atmospheric pollution adjacent to the compressor so as to enable the manufacturer to select a proper filter.

**10.2.2** The position of filter shall be such as to permit easy cleaning. Filter shall be placed as close to compressor as possible and suck air as near to the atmospheric temperature as possible.

**AMENDMENT NO. 1      AUGUST 1989**

**TO**

**IS : 11012 - 1984    TECHNICAL SUPPLY CONDITIONS FOR RECIPROCATING  
AIR COMPRESSORS ABOVE 25 AND UP TO AND INCLUDING 60 kW**

( *Page 4, clause 19.1.1* ) — Insert the following Note at the end:

' **Note** — Applicable to compressors with forced feed frame lubrication system. '

( *Page 5, clause 20.2, second sentence* ) — Substitute the following sentence for the existing sentence:

'This guarantee shall be applicable for a period of 12 months from the date of supply or 2 000 working hours, whichever is earlier.'

( EDC 62 )

**10.2.3** The purchaser may specify any special requirement regarding filtering particle size in microns and required efficiency, otherwise manufacturer may furnish the standard filter and state the normal cleaning interval.

**10.2.4** For non-lubricated compressors, dry filters shall be furnished.

**11. Intercoolers** — In case shell and tube type of coolers are used, the design and construction of the same shall be in accordance with IS : 4503-1967 'Specification for shell and tube type heat exchangers'.

## **12. Prime Mover and Drive Equipment**

**12.1 General** — The purchaser shall specify in the enquiry the type of prime mover required, namely electric motor, diesel engine, spark ignited engines, etc.

### **12.2 Prime Mover**

**12.2.1** In case, the prime mover is required to be supplied along with the compressor the purchaser shall specify in the enquiry the technical data required for the prime mover design ( type of motor, electrical supply characteristics, type of engine, etc ) and also the standard or code to which the same shall conform. The standard shall be the relevant Indian Standard.

**12.2.2** The prime mover shall be such that it is capable of running the compressor at least at 110 percent of the rated power.

**12.2.3** The prime mover shall have sufficient starting torque so as to be capable of starting the compressor and running it up to full speed with open discharge.

**12.2.4** When the prime mover is to be procured by the purchaser, the supplier shall furnish the following data:

- a) Compressor and transmission starting torque characteristics,
- b) Inertia value (  $GD^2$  ),
- c) Mounting or coupling details or both, and
- d) Maximum power required under worst operating condition.

**12.2.5** In case of turbine driven compressor, they shall be provided with an over-speed shut-down device capable of being manually tripped and re-set. The over-speed trip shall be such as to prevent for running at a speed greater than the maximum allowable speed.

**13. Special Requirements for Non-Lubricated Construction** — The compressor shall be provided with an extra long distance piece of sufficient length to prevent oil carry over.

**14. Lubrication** — Splash type lubrication system shall be provided. Forced lubrication system may be provided if specified in the contract or order. Bottoms of crank chambers are formed as oil reservoirs and they shall prevent oil leakages and dust intrusions from open air.

## **15. Air Receivers**

**15.1** Maximum working pressure of the air receiver shall be higher than the rated pressure of the compressor according to IS : 7938-1976 'Specification for air receiver for compressed air installation'.

**15.2** Air receiver shall be of circular shape and the end plates shall be of dished or semi-spherical shape and shall have sufficient strength. Air receivers shall conform to IS : 7938-1976.

**15.3** Air receivers upon which equipment such as compressors are mounted shall be capable to withstand the stresses due to weight, starting and stopping of the machine.

**16. Base Plate** — Base plate shall be of suitable construction to withstand the weight of the compressor unit and the driving prime mover along with the associated vibration developed.

## **17. Couplings, Reduction Gears and Guards**

### **17.1 Coupling**

**17.1.1** Various types of couplings as friction disc coupling, tyre type internal gear type and centrifugal clutch type coupling may be used. If the coupling used is of cast iron of flexible type, the same

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shall conform to IS : 2693-1980 'Specification for bush type flexible couplings for power transmission (first revision)'.

**17.1.2** The coupling design shall be such that it can be replaced without dismantling the internal parts of the compressor or the prime mover. This does not prohibit the removal of prime mover from its location.

**17.1.3** Coupling shall be suitable for expansion and any other movement of the shaft.

**17.1.4** The drive may be through a gear box or it may be directly connected or integral as appropriate.

### **17.2 Reduction Gears**

**17.2.1** Gears shall be of suitable design and make. Accuracy requirements shall be as per IS : 4702-1968 'Accuracy requirements for high precision gears'.

### **17.3 Guards**

**17.3.1** Removable guards shall be provided on all movable parts which are likely to be hazardous to operating personnel.

**17.3.2** If guards are not removable; for example, fly-wheel guards, access openings (if necessary with covers) shall be provided to provide access to any part requiring attention or for rotating parts manually.

## **18. Piping**

**18.1** The pipe work required with the compressor consists of:

- a) *Air piping* — Inlet, interstage and final discharge piping; and
- b) *Auxiliary pipe work* — Lubricating oil, cooling water, drain and vent and instrument air piping.

**18.2** The scope of supply of pipe-work by the supplier shall be properly defined with terminal points clearly fixed. The supplier shall supply all pipe work to interconnected items of the supply leaving the number of terminal points for the purchaser connection to a minimum.

Auxiliary pipe work required for lubricating oil, cooling water, drain and vent and instrument air shall be machine mounted in fully erected and fabricated condition unless otherwise specified.

**18.3** Unless otherwise specified, the supplier shall supply the pipe work to the standard of choice.

**18.4** The pipe work shall be free of loose rust, slag, welding beads and other foreign matter.

**18.5** The water pipe-work shall be fitted with high point vent and low pipe drain connection such that the entire system can be vented and drained.

**18.6** The water circuit of jacket shall incorporate a sight glass.

**18.7** For auxiliary lubricating oil pipe-work, the pipe down stream of oil filter and if made of carbon steel shall be duly pickled after fabrication.

## **19. Safety Measures**

### **19.1 Safety Devices**

- 19.1.1** *Lube oil* — a) Low pressure alarm (optional), and  
b) Low pressure trip.

**19.1.2** *Cooling water* — Trip for cooling water flow failure.

### **19.2 Instruments and Control**

#### **19.2.1 Capacity control**

#### **19.2.2 Pressure gauge**

- a) Interstage and final stage pressure, and
- b) Lube oil pressure.



**19.2.3 Temperature gauge ( optional )**

- a) Outlet air temperature,
- b) Inter stage temperature before and after inter cooler, and
- c) Lube oil temperature.

**20. Guarantee**

**20.1 Performance Guarantee** — The compressor shall be guaranteed for satisfactory performance at the specified operating conditions. These include a guarantee for flow rate and power at the time of performance test unless guarantees on other items have been specifically asked by the purchaser. The tolerances to be allowed on the flow rate and power consumption shall be according to IS : 5456 - 1969 'Code of practice for testing of positive displacement type air compressors and exhausters'.

**20.2 Workmanship Guarantee** — All equipments, components and spare parts other than bought out items shall be guaranteed by the supplier against defects which despite proper use appear therein and arise from defective or improper materials or poor or faulty workmanship. This guarantee shall be applicable for a period of 12 months or 2 000 h from the date of installation whichever is earlier. If any defects or malperformance is established during the guarantee period, the supplier shall make all necessary or desirable alterations, repairs and replacements free of charge.

**Note 1** — This guarantee does not apply to prime movers. However, this will be reviewed after a period of three years.

**Note 2** — The guarantee period stipulated for compressors shall also be reviewed after a period of three years.

**21. Marking** — The following particulars shall be marked at an easily visible place of the compressor:

- a) Description,
- b) Rated pressure of compressor,
- c) Rotational speed,
- d) FAD at the rated pressure of compressor,
- e) Registered trade-mark or name of the manufacturer, and
- f) Serial No. and year of manufacture.

**22. Tests on Compressors**

**22.1 Recommended tests** are enlisted hereunder. Compressors may be tested using a suitable motor, when compressors which are shipped without equipping a prime mover are to be tested:

- a) Volumetric and overall efficiency ( type test ),
- b) Lubricating oil consumption ( type test ),
- c) Capacity ( routine test ),
- d) Specific power consumption from no load to full load ( routine test ),
- e) Speed ( routine test ),
- f) Testing of unloader ( routine test ), and
- g) Safety valve test ( routine test ).

**Note** — The details of the above tests are laid down in IS : 5456 - 1969.

**22.2** All pressure containing parts shall be subjected to hydrostatic test pressure equal to 1.5 times the maximum allowable working pressure.

**22.3** The piping, pressure vessels, filters, coolers and the like shall be subjected to the hydrostatic test pressure of 1.5 times the design pressure or as specified by the purchaser.

**22.4** Safety valves shall be tested for smooth functioning and pressure for which it is installed.

**22.5** Other tests shall be performed in accordance with IS : 5456-1969.

**A P P E N D I X A***( Clause 3.1 )***RECOMMENDED MATERIAL OF CONSTRUCTION**

<b>Name of Part</b>	<b>Relevant Indian Standard</b>
Crank chamber	IS : 210-1978, IS : 617-1975
Cylinder or cylinder liner	IS : 210-1978
Cylinder bed	IS : 210-1978, IS : 617-1975
Fly wheel pulley	IS : 210-1978
Crank shaft	Grade 2 of IS : 2004-1978, IS : 961-1975
Connecting rod	Grade 2 of IS : 2004-1978, IS : 617-1975, IS : 961-1975
Piston	IS : 210-1978, IS : 617-1975
Piston pin	IS : 961-1975, IS : 1170-1967
Bearing bush	IS : 318-1981, IS : 305-1981
Crank pin bush	IS : 318-1981, IS : 305-1981
Piston pin bush	IS : 318-1981, IS : 305-1981, IS : 28-1975
Air reservoir	IS : 7938-1976
Base plate	IS : 210-1978, IS : 1030-1974
Dish of suction and delivery valve	IS : 1170-1967, IS : 4409-1973
Spring of suction and delivery valve	IS : 7906 ( Part 1 )-1976 IS : 7906 ( Part 2 )-1975
Disc and seat of safety valve	IS : 6603-1972, IS : 318-1981, IS : 305-1981
Spring of safety valve	IS : 7906 ( Part 1 )-1976, IS : 7906 ( Part 2 )-1975
Piston rings	IS : 8422-1977
Roller bearing, ball bearings	IS : 6454-1972, IS : 6455-1972, IS : 6456-1972, IS : 6457-1972, IS : 6458-1972
Bolts and nuts	IS : 1364-1967, IS : 1365-1978, IS : 1366-1968

**APPENDIX B**

( Clause 4 )

**DATA SHEET CONTAINING PURCHASER'S SPECIFICATIONS****B-1. General**

**B-1.1** Number of Units : Running  
Standby

**B-1.2** Site

**B-1.3** Service : Continuous Intermittent

**B-1.4** Installation : Indoor Out-door with roof  
Out-door without roof

**B-1.5** Type of Driver : Electric Motor Diesel Engine  
Petrol Engine Other

**B-1.6** Driver furnished by : Purchaser Supplier

**B-2. Required Operating Conditions****B-2.1** Site Data

- a) Barometric pressure
- b) Relative humidity : *Max* *Min* Design
- c) Ambient temperature : *Max* *Min* Design
- d) Special and environmental pollution  
Very sandy Very dusty In special corrosive  
atmosphere ( give details )
- e) Any special Electrical Equipment Hazard  
Class Grade Division.
- f) Cooling Water Supply for Compressor Cylinder — type of water, pressure and temperature of supply and return.
- g) Cooling water for oil cooler, inter-cooler, after-cooler-type of water, pressure and temperature of supply and return. Design pressure desired for water circuit.
- h) Instrument air supply if available.

**B-2.2** Electrical supply characteristics ( required if driver is motor which has to be included ).

**B-2.3** Capacity required ( each machine ) Voltage Frequency.

Inlet capacity :  
( alternatively capacity in standard air or Nm<sup>3</sup>/h ).

**B-2.4** Discharge pressure.

**B-2.5** Discharge temperature required  
( Specify only if after-cooler is required ).

**B-3. Capacity Control**

**B-3.1** For maintaining Receiver pressure at -  
this shall be by Suction valve unloaders.  
Start-Stop.  
Inlet throttling ( specify only  
if some particular preference exists ).

**B-3.2** Any other requirements.

**B-4. Special Requirements**

**B-4.1** Non-lubricated construction.



## APPENDIX C

( Clause 5.1 )

### DATA SHEET CONTAINING SUPPLIERS REQUIREMENTS

#### A — Cylinder Data

1. No. of stages
2. No. of cylinders per stage
3. Type of cylinder cooling required — air cooled/water cooled
4. Type of cylinder arrangement
5. Single/Double acting
6. Cylinder liner Yes/No
7. Cylinder liner Wet/dry
8. Outside diameter of liner in mm
9. Bore, mm
10. Stroke, mm
11. Piston displacement
12. Percentage clearance
13. Volumetric efficiency, percent
14. Valve gas velocity, m/min
15. No. of inlet/discharge valves/cylinder
16. Type of valves
17. Inlet/discharge valve lift, mm
18. Maximum allowable piston speed, m/min
19. Normal piston speed, m/min
20. Rod diameter, mm
21. Maximum allowable rod loading, t
22. Maximum allowable cylinder working pressure, MPa
23. Maximum allowable cylinder temperature, °C
24. Suction flange size, rating/facing
25. Discharge flange size, rating/facing

#### B — Material

1. Cylinders
2. Cylinder liners
3. Pistons
4. Piston rings
5. Rider rings
6. Piston rods
7. Piston rod hardness, *HRC*
8. Valve seats
9. Valve stops
10. Valve plates
11. Valve springs
12. Rod packing
13. Bearings

**C — Utility Consumption**

<i>Electric</i>	Power Rating kW	Starting Motor	Full Load current
		A	A
1. Main prime mover	—	—	—
2. Main lube oil pump ( if driven by a separate motor )	—	—	—
3. Auxiliary lube oil pump ( if driven by a separate motor )	—	—	—
4. Packing coolant oil pump ( if driven by a separate motor )	—	—	—
5. Frame oil heater	W	V	— Hz
6. Lubricator heater	W	V	— Hz
7. Space heater	W	V	— Hz
<i>Cooling water</i>		<i>Cylinder</i>	<i>Lube oil</i>
1. Quantity m <sup>3</sup> /min	—	—	—
2. Inlet temperature, °C	—	—	—
3. Outlet temperature, °C	—	—	—
4. Inlet pressure, MPa	—	—	—
5. Outlet pressure, MPa	—	—	—
6. Maximum pressure, MPa	—	—	—

**D — Capacity Control**

1. Type of Control
2. Cut off pressure, MPa
3. Cutting in pressure, MPa

**E — Weights and Dimensions**

1. Maximum erection mass, kg
2. Maximum maintenance mass, kg
3. Total mass less driver and gears, kg
4. Approximate floor space
5. Length -- Width — Height
6. Rod removal distance

**F Rated Operating Conditions ( Each Compressor )**

1. Relative humidity
2. Inlet temperature, °C
3. Inlet pressure, MPa
4. Pressure drop between stages, MPa
5. Actual discharge temperature, °C
6. Discharge pressure, MPa
7. Compressor, kW
8. Transmission losses, kW

**EXPLANATORY NOTE**

With the constantly increasing use of compressors in diversified fields, need was felt to bring out standards on performance and other relevant data useful to both users and manufacturers. Considerable progress in this direction has been made during the last two years by the publication of some standards relating to compressors

This standard covers the technical supply condition for reciprocating air compressors above 25 up to and including 60 kW. Technical supply conditions for reciprocating air compressors above 60 kW are covered in IS : 10962-1984. Technical supply conditions for reciprocating compressor below 25 kW are also being covered separately in another standard.